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THOMAS HENRY HUXLEY.

HUXLEY died on June 29th, having attained the age of seventy years on May 4th. His death was not unexpected, as he had been lying ill at Eastbourne for nearly four months, nor can it be regarded as premature, as his important contributions to science ceased some fifteen years ago. But the vigor of his thought and language had remained unabated, and his death, following that of Tyndall, leaves a great blank in the group of men who from England have directed the course of modern science.

Huxley made his own way, his father having been an undermaster in a school in the Middlesex village of Ealing. He became a surgeon in the navy and spent four years in a cruise in the South Seas. A sea voyage was thus the determining factor in his life, as in the case of Darwin. Several communications sent home to the Linnæan Society were rejected, but in 1849 the Royal Society published his paper on the *Anatomy and Affinities of the Medusæ*, and in 1851 he was elected a fellow of the Society. He was disappointed in his hopes that the admiralty would publish his great work on *Oceanic Hydra* (which finally appeared in 1859), and resigned his position in the navy. After several failures to secure a position (he and his friend Tyndall applied unsuccessfully for vacant chairs in the University of Toronto) he succeeded Forbes in 1854 as paleontologist and professor of natural his-

tory in the Royal School of Mines, and held these positions until his retirement from active work in 1885.

In the same year he was appointed Fullerian professor of physiology in the Royal Institution and examiner in physiology and comparative anatomy in the University of London. In the thirty years that followed he filled a large number of positions, some honorary and some requiring a large expenditure of time and labor. In 1858 he was Croonian lecturer to the Royal Society; from 1863 to 1869 he was professor of comparative anatomy to the Royal College of Surgeons; in 1875–6 he acted as substitute in the chair of natural history in the University of Edinburgh; from 1870–2 he was a member of the first London School Board; from 1881–5 he was inspector of salmom fisheries. He was Lord Rector of the University of Aberdeen, president of the Geological and Ethnological Societies, president of the British Association, and secretary and president of the Royal Society. He received degrees from Oxford, Cambridge, Edinburgh, Dublin, Würzburg and Breslau, and was a member of the leading scientific societies and academies of the world.

Owing to failing health—his heart was affected—Huxley retired from active work in 1885, and latterly had been living by the sea. He suffered from an attack of influenza early in March, from which he did not recover, and finally succumbed to cardiac and pulmonary complications. He was interred on July 4th, in Marylebone cemetery, Finchley, where his eldest son lies buried. His wife, three sons and four daughters survive him.

Huxley's zoölogical writings cover the whole range of the science from the protozoa to man, including an equal consideration of living and extinct species. But his interests and publications were by no means confined to zoölogy. He wrote excellent introductions to physiology and physiography. He discussed many problems, from Hume's philosophical scepticism to the 'Salvation Army.' Indeed, his original contributions to zoölogy are at present overshadowed by his fame as a teacher and advocate. Perhaps he would himself have regretted this. He wrote in 1894 (referring doubtless to Tyndall): "At the same time it must be admitted that the popularization of science, whether by lecture or essay, has its drawbacks. Success in this department has its perils for those who succeed. The 'people who fail' take their revenge, as we have recently had occasion to observe, by ignoring all the rest of a man's work and glibly labelling him a mere popularizer."

But Huxley was undoubtedly fitted for the work he accomplished. His thought was clear and his character forcible, and these are admirably reflected in his language. It may seem to us that the batteries are needlessly heavy in view of the defences, but there is truth in what he said with not uncharacteristic self-assertion—his work has been 'inclosed among the rubble of the foundations of later knowledge.' Huxley has described what he aimed to do and what he accomplished better than another can—he wrote:

"To promote the increase of natural knowledge and to forward the application of scientific methods of investigation to all the problems of life to the best of my ability, in the conviction which has grown with my growth and strengthened with my strength that there is no alleviation for the sufferings of mankind except veracity of thought and of action, and the resolute facing of the world as it is when the garment of make-believe by which pious hands have hidden its uglier features is stripped off. It is with this intent that I have subordinated any reasonable, or unreasonable, ambition for scientific fame, which I may have permitted myself to entertain, to other ends; to the popularization of science; to the development and organization of scientific education; to the endless series of battles and skirmishes over evolution; and to untiring opposition to that ecclesiastical spirit, that clericalism, which in England, as everywhere else, and to whatever denomination it

may belong, is the deadly enemy of science. In striving for the attainment of these objects, I have been but one among many, and I shall be well content to be remembered, or even not remembered, as such."

THE ST. ELIAS BEAR.

A BEAR has been for some time reported as frequenting the vicinity of the glaciers of the St. Elias Alpine region, which is regarded by the Indians and hunters as a distinct species from either the black or the large brown bear of Alaska. It is of moderate size, the largest skins not exceeding six feet in length, and is reported to be shy and less fierce than either of the others. The examination of four well preserved trapper's skins of this animal in the possession of Major Turner, of Sitka, has convinced me that we have to do with an animal which is unlike either of the common bears of the region, and specifically distinct from the brown bear of Alaska, which has been cited of late under the name of *Ursus Richardsonii* of Mayne Reid, though perhaps forming a separate race from the typical Barren Ground bear. Whether the St. Elias bear forms a distinct species from the black bear is doubtful, but it is at least a well defined local race, to which I have seen no approximation among the thousands of black bear skins which I have examined in past years in the hands of traders in this Territory. As such it seems desirable to call attention to it by such a description as is practicable at this time.

The general color of the animal resembles that of a silver fox. The fur is not very long, but remarkably soft and with a rich under fur of a bluish black shade, numbers of the longer hairs being white, or having the distal half white and the basal part slaty. The dorsal line from the tip of the nose to the rump, the back of the very short ears, and the outer faces of the limbs, are jet black. Numerous long white hairs issue from the ears; black and silver is the prevalent pelage of the sides, neck and rump; the under surface of the belly and the sinuses behind the limbs are grayish white, or even nearly pure white, I am told, in some cases. The sides of the muzzle and the lower anterior part of the cheeks are of a bright tan color, a character I have not seen in any other American bear; and this character is said to be invariable. There is no tint of brown elsewhere in the pelage. There is no tail visible on the pelts. The claws are small, very much curved, sharp, black above and lighter below; the animal evidently can climb trees, which the brown bear cannot do.

This bear is known to range about the St. Elias glaciers, especially near Yakutat, and a single specimen has been killed on the mountains as far east as Jureau. About thirty-five skins have been brought to Sitka, mostly from Yakutat. A mounted skin, the only one known as yet (said to contain the skull), is in the possession of Mr. Frank A. Bartlett, of Port Townshend, Wash.

My attention was called to this animal by Lieut. G. T. Emmons, U. S. N., well known in connection with the fine collection of Alaskan ethnology in the American Museum of New York; and I would suggest the varietal name of *Emmonsii* for the St. Elias bear. It is also known among the fur dealers here as the Glacier, or the Blue bear. I hope to be able to secure specimens of the skin and skull for the National Museum, through the Yakutat hunters, later.

It is worthy of note that the Indians report another animal unknown to naturalists, on the higher mountains of the mainland. It is said to resemble the mountain sheep and to have horns nearly as long but almost straight, like those of an ibex. Lieut. Emmons is confident that these reports have a basis in fact.

WM. H. DALL.

SITKA, ALASKA, June 28, 1895.

THE CAUSES OF THE GULF STREAM.

Shortly after the first voyage of Columbus, the existence and some of the characteristics of the Gulf Stream became known, and with Franklin's experiments as to its temperature, scientific observations upon it began. Since then, many other observations as to its depths in places, temperature and direction have been added to the sum of information on the subject, knowledge of which, in the form of scientific reports, monographs and magazine articles, has more or less found its way to the public; some of the accounts, however, stopping very far short of the ultimate interest in the subject derivable from determination of the causes of the stream. The statement that the trade winds heap up the equatorial waters on the eastern shore of Central America, thereby giving a 'head' to the Carribean Sea and the Gulf of Mexico, seems to suffice to most persons for an all-sufficient explanation of the generation and behavior of the Gulf Stream. But it ought to be obvious that, although winds do, as is observable in small areas, heap up waters against obstructive lines upon which they impinge, the movement of the equatorial waters towards the west cannot be the sole cause of the Gulf Stream. On the contrary, whatever head actually exists there is produced by several agencies causing the thrust of waters in the form of a mighty current.

Seeking for a single cause of the phenomena, one will be foiled. He would make an attempt at the bottom of much unproductiveness in research, arising from seeking in nature for some one cause to account for any phenomenon in its entirety. In seeking, therefore, for the cause of the Gulf Stream, we must resolve the idea of cause into that of causes, called, if one will, primary, secondary, etc., but still, in the aggregate, activities of many existing conditions. These are the globular form of the earth; its rotation on its axis; the difference, in correspondence with latitude, of its rotary velocity; the difference in temperature, involving density, between polar and equatorial waters; the direction and force of the trade winds; the head of water produced by those winds and other agencies at the the Gulf Stream, and the correspondingly lower level at the places whence a portion of its waters are so derived; the volume of discharge contributed to the Carribean Sea and the Gulf of Mexico by the rivers flowing into them; the increase in volume of those waters through the long continued heat to which they are subjected while confined within the caldron formed by those basins—these, and nothing less, represent in fact the assemblage of the causes of the Gulf Stream.

The Coast and Geodetic Survey of the United States has, within the last few years, made very valuable additions to knowledge of the Gulf Stream, through the investigations of Lieutenant Pillsbury, of the Navy, commanding the steamer Blake, but these relate to details, which although interesting, do not involve the largest question relating to the stream in its very existence. Lieutenant Pillsbury established the fact of the absence of the supposed hill ranges, in and parallel to the trough in which the stream for a while flows in its course along the shores of the United States; the indeterminateness of the position of its boundary line, constituted by Arctic water lying between it and the coast, well described by the term 'cold wall,' and he also proved the indeterminateness of the bands of alternating warm and cold water in the stream, caused by the irregular dispersion of surface water by winds. The impossibility of recognizing at all times by temperature the position of the axis of movement of the stream is thus clearly shown. He discovered fluctuations in the stream, in direction and strength, as dependent upon the

position of the moon; and the influence of the pressure of the atmosphere over large conterminous areas of high and low barometer, in accelerating or retarding the current. He also determined the presence of a fringe of current on the east of the Gulf Stream proper, proceeding at a slower rate than it, and conformably in direction. These and other points make a very interesting series of discoveries, but they do not touch the causes of the Gulf Stream. They relate solely to the agencies which modify it. Were all these conditions absent, the Gulf Stream, merely as a body of water flowing in the direction which it now pursues, would still exist substantially as at present.

In the particular not relating to influences merely modifying the stream, but to the question how such portion of its waters as have passed into the Carribean Sea and the Gulf of Mexico, under the influence of the trade winds, have been translated thither, the present writer cannot agree with Lieutenant Pillsbury. For, whereas Lieutenant Pillsbury's observations at the Windward Islands show, as their result, that the water there entering the Caribbean Sea, as a current, represents only about half of the volume which he determined as flowing out of the Straits of Florida, as the Gulf Stream, he accounts for the other half by supposing that, in addition to the flow into the Caribbean Sea at the Windward Islands, a great amount is also delivered there by the toppling of the seas towards the west as they roll on towards and through the passages between the islands. That any force of wind, however great or small, could be resolved, on the one hand into a current, and on the other into waves, and the volume of the latter be available in helping to fill an interior basin through openings of an archipelago, does not agree with dynamic laws known and admitted. Toppling seas proceeding in any given direction resolve themselves into and quicken current; in fact, current in water, as derived from wind, is conditioned upon the ruffling of the surface, whether in the form of a ripple or a billow. Therefore current and wave are not dynamically separable as agencies of transportation. It follows that, if the Windward Islands' observations show only about half the volume of water delivered into the Atlantic by the Gulf Stream, the remainder is chiefly to be accounted for by a volume of the polar current underrunning, and running by the sides of the Straits of Florida. Plus the other supplies already mentioned, and minus evaporation, we have then the sum-total volume of water with which nature is dealing in the production of the stream.

The primary causes of the Gulf Stream are the rotation of the earth, the difference of density between its polar and equatorial water, and the presence of the American continent. For, if we will eliminate in imagination every agency but these, including the trade winds, we shall shall see that we have, through the facts of the form of the earth and this difference of density, the resultant of two lines of force represented by the tendency in the direction of waters so constituted to flow. On one of these the centrifugal force of the earth's rotation draws the waters as a sub-marine flow from the poles to the equator, resulting in a supra-marine flow from the equator to the poles; while, on the other, the rotation of the earth on its axis, at right angles to those directions, tends to make the waters move directly towards the east. If there were no continents at all on the surface of the earth, the effect of this, as viewed from the equator, would be to make the sub-marine flow from the pole, in the northern hemisphere, assume a southwesterly curve convex towards the equator; and to make the supra-marine flow, from the equator to the same pole, assume a northeasterly

curve, concave towards the equator. Similarly, with reference to the southern hemisphere, as viewed from the equator, the submarine flow from the pole would assume a northwesterly curve, convex towards the equator, and the supra-marine flow from the equator to the pole would assume a southeasterly curve, concave towards the equator. The reason for this is that the sub-marine flow, coming from the north or the south pole, would reach successively degrees of latitude of greater and greater velocity of rotation, and therefore would assume a more and more westerly direction, whereas the flow going from the equator towards either pole would successively reach degrees of latitude of less and less velocity of rotation, and therefore would assume a more easterly direction.

The very same causes are operative now to produce the very same effect, and the chief reason that it does not exist in the simplicity described is on account of the presence of continental lines disposed in a northerly and southerly direction. Yet, despite the complication thereby introduced into the phenomenon of ocean movement by that and other causes, the surface waters of the ocean, without regard to the streams coursing through them, move in a general direction in the northern hemisphere towards the northeast, and the sub-marine waters towards the southwest; while, in the southern hemisphere, they move correspondingly, the surface waters towards the southeast, and the sub-marine waters towards the northwest. Owing to the causes which have now been detailed at sufficient length, the sub-marine waters lag behind the surface waters, and therefore the surface flow from the equator to the poles assumes a relatively easterly position with respect to the sub-marine flow from the poles to the equator. The inclusion of the agency of the north and south continental lines, and the presence of constant winds in certain quarters of the earth, do not create the movements of the oceans, but merely serve to modify with great intricacy the general flow.

The movements just described as deducible from general principles, and long previously held to be true, have in quite recent times been proved true by various scientific observations, notably by those of the British ship Challenger, Captain Nares, in 1873–1876. Having thus settled once for all in our minds that the primary cause of the Gulf Stream is not the influence of the trade winds, to which it has long been ascribed, but that it is derived from causes which were the basis of theory broached many years ago, the correctness of which is fully established, let us proceed to introduce for the completed phenomenon the chief subsidiary agencies which make the Gulf Stream what it is as observed.

The Equatorial Current is known technically as a drift current, that is, one formed by the friction of the wind on the surface of water. The Equatorial Current is, in consequence, not a deep current. According to Sir Charles Wyville Thomson, scientific director of the Challenger expedition, its movement does not reach below fifty fathoms in depth. Moreover, it is not, as commonly spoken of, a single current, but is divided into a northern and a southern stream. The thermal equator does not coincide exactly with the geographical equator, but lies two or three degrees north of it. In consequence, as the trade winds, the cause of the Equatorial Currents, blow from the northeast and southeast, the position of those winds is determined by that of the thermal equator, and the whole equatorial system of winds and currents tends more to the north than to the south of the equator, the southern limit of the northeast trade winds, with the southern declination of the sun, not reaching, by two or three degrees, to the geographical equator, while,

on the contrary, the northern limit of the southeast trade winds sometimes passes, with the northern declination of the sun, as much as five degrees above the geographical equator. Between these two currents, whose north and south limits are respectively above the line of the Tropic of Cancer and below that of the Tropic of Capricorn, depending upon the annual declination of the sun, and always ranging higher above the Tropic of Cancer than below the Tropic of Capricorn, lies the region of equatorial calms, squalls and variable winds, called by sailors the doldrums, within whose eastern area a counter current, of length varying according to the season, contributes to the Guinea Current on the coast of Africa, also contributed to by the cool southerly current along the northwest coast of Africa, called the North African Current.

It will readily be seen from the above statement and from examination of the map of the Atlantic that, during the summer season of the northern hemisphere, the largest contribution by the Equatorial Currents must be made to the Gulf Stream, for not only is the whole of the North Equatorial Current then, as always, north of the equator, but the South Equatorial Current not only overlaps the equator, but extends then for some distance to the southward in a favorable position for the entrance of much of its water, deflected to the northwest by Cape Roque, and then known as the Guiana Current, to enter the Carribbean Sea. In both seasons the Atlantic northern hemisphere must therefore receive and deliver from near the equator a larger supply of surface-moving water than the southern Atlantic hemisphere ever thence receives and delivers. The slower current in the same direction, on the eastern edge of the Gulf Stream mentioned by Lieutenant Pillsbury, is clearly shown by the observations of the Challenger, in ascending and descending the coast of the United States, to be the edge of a broad band of water enveloping the Bermudas. It is therefore part of the great general easterly and northeasterly movement of the Atlantic waters of the northern hemisphere, a portion of which movement eventually impelled by the anti-trade winds gradually goes to constitute the reflux flow towards Africa, called the Northern Connecting Current.

It has been here said that the body of water which enters the Caribbean Sea as drift currents, produced by the northeast and the southeast trade winds, leaves the residuum to be chiefly supplied by the flow of the polar current under and beside the Gulf Stream issuing from the Straits of Florida. To this is to be added the volume discharged into the Gulf of Mexico and the Caribbean Sea by the various rivers, and we have what makes, allowing for increase and diminution of volume from temperature and evaporation, the sum-total volume to be reckoned for as creating the head of water in the Gulf of Mexico. Taking the temperature of the general sea surface on a line just outside of the Greater and Lesser Antilles to be about 74 F., it is well below that recorded in the Straits of Florida by Lieutenant Pillsbury and other authorities, as often over 80 F., one of them giving a record as high as 86 F. That there should be a considerable rise of temperature between the equatorial waters and those of the Gulf of Mexico, in the Straits of Florida, should not surprise anyone who knows that, according to the investigations of the Challenger, cool water has been found to rise more closely to the surface nearly under the equator than elsewhere in the Atlantic and the Pacific, the temperature of 40° F. reaching to within three hundred fathoms of a surface at nearly 80 F. The equatorial surface generally is surprisingly cool, considering its geographical position, and the equatorial waters are of a lower salinity than are the tropical waters on either side. We

thus see at a glance, not only that they are polar waters which we find immediately below the surface under the equator, but that the moderate temperature and density of the surface are due to their proximity and intermingling with others. Starting, as they do, with greater density than that which, without their translation, would be possessed by waters at the equator, they become, through conduction and convection of heat, of less density than the equatorial surface water, because their pristine density was due to cold, which they finally lose. To suppose that the whole body of water in the Caribbean Sea and the Gulf of Mexico should rise in temperature through all its strata, intermediately to its passage out of the Straits of Florida, would be preposterous; but when we remember that the course taken by these various strata before culminating in a current departing for the high seas represents weeks of time and coincident confinement in a landlocked embayment of the ocean, we ought to perceive that their increase in volume, if not general, must be considerable.

Dr. Carpenter, whose influence was largely instrumental in bringing about the voyage of the Challenger, and who freely uses the data collected by it, says, in his article, *The Atlantic*, in the last edition of the Encyclopædia Britannica: "It is not a little remarkable that the subsurface stratum of water, having a temperature above 40 F., is thinner under the equator than it is in any other portion of the Atlantic from the Faröe Islands to the Cape of Good Hope. Notwithstanding the rise of the surface-temperature to 76°–80° F., the thermometer descends in the first 300 fathoms more rapidly than anywhere else; as the polar water is met with at a much less depth than in the North Atlantic, and 100 fathoms nearer to the surface, than even in the cooler South Atlantic; whilst the temperature of the bottom is but little above 32° F." Again, he remarks, in the same article: "The isotherm of 40° F., which, in latitude 22° North, lies at a depth of 700 fathoms, gradually rises as the equator is approached, and it is between the equator and 7° South Latitude, where the temperature rises to nearly 80° F., that cold water is soonest reached—the isotherm of 40° F. rising to within 300 fathoms of the surface, while that of 55° F., which in latitude 22° North lies at nearly 400 fathoms' depth, and in latitude 22° North at about 250 fathoms, actually comes up under the equator within 100 fathoms of the surface."

Both Dr. Carpenter and Professor Lenz, of St. Petersburg, however, the latter of whom, from observation made as early as 1825–1826, in the voyage of the Kotzebue, had propounded a theory of such oceanic circulation as that implied by the preceding facts. Dr. Carpenter, in ignorance of having been anticipated, adopted the same views, ascribing the general oceanic movement to a general vertical oceanic circulation sustained merely by the difference of temperature between the polar and the equatorial regions; which theory unwarrantably omits the agency of the rotation of the earth on its axis as one of the primary factors in the phenomena concerned.

It is generally conceded that the Gulf Stream is no longer recognizable as a current beyond 30° West Longitude, but it is not therefore to be supposed that all the waters belonging to it just previously are frittered away and have mysteriously disappeared. As it gradually thins and spreads out in its passage towards the northeastward across the Atlantic, and at the same time gradually diminishes in temperature, it becomes more and more a portion of the grand sweep of surface water from the equator towards the northeast, becoming an integral portion of that movement; and because it is no longer recognizable as a current beyond 30° West Longitude, it does

not follow that its force, added to by the anti-trade wind movement, is expended, but on the contrary, that its force, although imperceptible as a distinct current, is merged in that of the more generally eastwardly movement, and contributes to the general effect. With what vehemence this general movement may act is seen through the report for 1893, of the Fishery Board of Scotland, which, through a scientific exploration of the coast of Norway, the North Sea, and the channels between Scotland and Iceland, in which the Orkney, Shetland and Faröe Islands appear, has discovered that a warm drift current from the Atlantic often sweeps in one place towards the North Sea from the Atlantic. Whether or not it is wholly a drift current, that is, one due to wind, the extraordinary warmth of the northeast Atlantic is thereby affirmed, and the correspondence of the fact with the previous statement is clearly perceptible.

Leaving further discussion of the Gulf Stream at this point, it is proper to conclude with a brief description of the reflux movement of the waters of the Atlantic, corresponding with their westward movement, described in connection with the generation of the Gulf Stream. To speak first of the North Atlantic, the anti-trade winds, and a reflux from the North Equatorial Current, form a current called the Northern Connecting Current, which sweeps around towards the east, in the North Atlantic, from the shores of North America towards those of Africa, enclosing between itself and the North Equatorial Current the well-known waters covered with floating weed, called the Sargasso Sea. Nearing the coast of Africa it passes towards the southeast, and although a portion of it is drafted off into the Guinea Current, another is swept into the North Equatorial Current to renew its ceaseless round. Turning to the Southern Connecting Current we find that a portion of it, known then as the Brazilian Current, passes down along the coast of Brazil, is then deflected towards the east, in a curve corresponding with reference to the equator to the curve of the Northern Connecting Current, and that it finally passes towards the northeast, off the coast of Africa, where a portion of it is drafted off to form the cool South African Current, while another portion turns into the South Equatorial Current, to continue with reinforcements a round similar to that of the Northern Equatorial Current. The reflux Equatorial Current between the North and South Equatorial Currents flows into the Bight of Biafra, helping with the cool North African Current to compose the Guinea Current.

The influence of the rotation of the earth is well exhibited by these movements. The Brazil Current, in passing southward soon to become a portion of the Southern Connecting Current, is going towards degrees of latitude where the earth's rotation is less swift than it is in the place whence it started. Hence it gradually assumes a curve towards the east, when, finally, it is deflected in quite an eastwardly direction by the pressure on its flank of the Antarctic Current, crowding up along the shore of South America, and additionally receives the impulse of the anti-trade winds of the region towards speeding it on its journey towards the east. Very nearly the same thing takes place in the northern hemisphere with reference to the Northern Connecting Current, the sole difference being that in the latter case the Gulf Stream receives the shock of the Arctic Current on its flank, and thereby shields the North Connecting Current from encroachment on its flank, to which, however, it would be less liable on account of the difference of the lay of the land in North America as compared with its lay in South America.

As both the Northern Connecting Current and the Southern Connecting Current run for the greater part of their courses due

east, and, therefore, the direction of their courses is not, during that portion of their journey, influenced by the rotation of the earth, and as the flow in the opposite direction of the North Equatorial and the South Equatorial Current is perennial, if not strictly constant, and lastly, as there is so great a discharge of water from the Equatorial Currents into the North Atlantic, a constant replenishment of the waters at the sources of the Equatorial Currents is implied with a certainty which involves the certainty that the level of the ocean off the southern coast of Africa is lower than that off the coast of Central America. That the difference between these levels, whatever it may be, is relatively but a small factor in the movement of the Gulf Stream, is self-evident, but as an entering factor it is proper that it should be mentioned. We can justly conceive, however, of a modified Gulf Stream, even if the level of the Caribbean Sea and the Gulf of Mexico were precisely the same with that on the African coast, at the sources of the Equatorial Currents, because it is dynamically part of a movement larger and inclusive of the waters of the whole globe; but we cannot conceive of difference of oceanic level not being an indispensable factor in the movement of the Gulf Stream as it actually exists, and in that larger movement. Whatever agencies, single or collective, are in play must be associated with differences of ocean levels. Assume changes in the present differences of level, and we must recognize that the phenomena of ocean movement would enter upon new phases. Assume that there is no difference of level anywhere, and we should see that the present phenomena would become inexplicable.

It obviously does not follow from appreciation of the valuable results in pelagic history, in the physical hydrography of the sea, and in other departments of knowledge obtained by the Challenger expedition, that one must agree in opinion with the distinguished chief of its scientific staff in all of his conclusions. Comparing the opinion of Dr. Carpenter with the opinion about to be cited from Sir Charles Wyville Thomson, it will become evident that the former, although accepting the fundamental fact acquired by the Challenger, does not, any more than the present writer, agree with a certain one of the conclusions of Sir Charles Wyville Thomson with reference to the cause of the general vertical oceanic movement. Both Sir Charles Wyville Thomson and Dr. Carpenter ascribe the general vertical oceanic movement to the welling up of the cold waters of the Southern Ocean into the Atlantic and the North Pacific. But, whereas both believe that condition to depend upon a movement sustained merely by the difference in density between the polar and the equatorial waters, Sir Charles Wyville Thomson additionally believes the excess of water received at the equator from the Southern Ocean, as compared with the amount received from north of the equator, to be owing to the excess of precipitation over evaporation in the southern hemisphere, which, of course, involves the excess of evaporation over precipitation in the northern hemisphere. Now, although it is recognized that there is in the southern hemisphere an excess of precipitation over evaporation, the degree, in that particular, of difference between the two hemispheres is not, as Sir Charles Wyville Thompson himself admits, even approximately known, and whatever it may legitimately be assumed to be, it is hardly to be recognized as capable of producing the relatively great general flow from the Southern Ocean to the extent indicated by him. Moreover, the theory is not compatible with the fact that as the equator is approached from either pole the specific gravity of the surface water of the ocean becomes higher and higher, and then lower and lower, until the water reaches

its lowest density in the equatorial region. According to the hypothesis, therefore, of the general vertical oceanic circulation (which is true, but not as depending upon temperature alone), and to the superadded hypothesis that the excess of precipitation in the southern hemisphere causes the thrust of sub-marine cold water into the Atlantic and North Pacific, we should find, what we do *not* find, on account of that very excess of precipitation in the southern hemisphere—the surface waters receding everywhere south of the equator, from the equator towards the southeast, to be of very low specific gravity; which contradicts the statement premised with reference to the specific gravity of the surface waters on each side of the equator, which statement truly represents the facts of the case.

As long as the earth under its present physical conditions shall endure, the movements of the ocean must remain as they now exist, passing through phases of maxima and minima of volume and velocity and oscillation in direction, dependent upon their astronomical and terrestrial relations. The present oceanic forces are, in fact, huge hydraulic engines, worked by nature from the north pole and the south, nor less from the equator and the revolution of the earth. The Gulf Stream, with the analogous Japan Current, is merely one of the two greatest products of that machinery, the flow from its colossal pump, in the direction of its discharging tube and the general circulation of the ocean, partially actuated by the earth's rotation and by the sun-generated winds, being ceaselessly engaged in life-giving and life-aiding agency on the globe.

R. MEADE BACHE.

PHYSIOLOGY IN 1894.

No striking discovery in physiological science was made in the year 1894, and yet a large amount of substantial work has been accomplished both at home and abroad. Only a few of the more remarkable researches can be here referred to. It has long been known that the swimming or air bladder of sea fishes contains a much larger percentage of oxygen than exists in atmospheric air. The amount may rise as high 85 per cent. The mode of storage of this large amount of oxygen has always been an interesting question with physiologists, taken in connection with the very small amount of oxygen in sea water. Light has been shed on this problem by the ingenious researches of Professor Bohr, of Copenhagen, who has succeeded in tapping the air bladders of codfish and of drawing off the gas by means of a trocar and an air-tight syringe. He found that the gas contained 52 per cent. of oxygen. In a few hours the bladder was refilled apparently by a process of secretion of gas from the blood in the capillaries on the wall of the bladder, and in one experiment the gas thus secreted contained no less than 80 per cent. of oxygen. Puncture of the air bladder always caused increased secretion of oxygen, but after section of the nerves supplying the organ the evacuated bladder was not refilled with gas. Thus the formation of the gas in the air bladder, which corresponds to the lung of air-breathing animals, is a true secretion of a highly oxygenated gaseous mixture, and the secretion is evidently to some extent under nervous influences. These observations are very interesting when taken in connection with the hydrostatic functions of the swimming bladder. When a deep sea fish descends from near the surface the air bladder is compressed and the body is reduced in size, but to bring the body into equilibrium with the water the fish secretes gas in the air bladder so as to distend it and bring back the body to the original size. This newly-formed gas consists chiefly of oxygen. These experiments by Professor Bohr tend generally to support the theory that the

gaseous exchanges occurring in the lungs of air-breathing animals are not due to purely physical causes, such as different partial pressures of the gases, but to a true process of secretion and excretion.

Very considerable progress has been made in unravelling the intricate mechanism of the brain and spinal cord, and this has been accomplished mainly by the application of the Wallerian method of studying the degenerations that follow section of various strands of nerve fibres or destruction of gray matter. Mott has given experiments that support Munk's original conclusion that the motor area on the cortex of the cerebral hemispheres is also connected with sensations of touch and pressure, and is not solely for the emission of motor impulses, or, in other words, that the mechanisms for sensation and touch and for motor impulses are closely related in the brain. Bayliss, Bradford, Boyce, Sherrington, Langley and Anderson in this country have also investigated the convexions of the various spinal nerves with the great plexuses or networks from which issue the main nerves of the limbs, and thus physiologists are slowly accumulating knowledge that will by-and-by be of great value to the physician. It will be possible to correlate sensations in various areas in the skin and various muscular movements with certain nerve roots and with certain portions of the spinal cord. In other words, a new physiological anatomy will be established by experiment and facts will be discovered that could never be laid bare by the scalpel. The most notable advance, however, in nervous physiology has been made by Gustav Mann, of Edinburgh, who, following the lead of an American observer, has demonstrated material changes following the stimulation of nerve cells in the sympathetic ganglia, in the cord, and even in the brain itself. Under stimulation the cells appear to swell and to become clearer owing to a peculiar matter termed chromatin being used up. In this way even long continued stimulation of the retina by light has been found to cause changes, visible to the microscope and depicted by photography, in the nerve cells of the part of the brain which is the seat of the consciousness of vision.

Numerous researches have been made on the functions of the liver, kidney, pancreas and spleen, all going to show that these organs are not related only to one or even two individual functions, but that each organ is the seat of complex metabolisms, or changes of which the obvious secretion is only the outward expression. Thus, the liver not merely secretes bile and forms glycogen, but it also has important antitoxic powers by which poisonous matters, formed possibly in the intestines and carried thence to the liver, have their effects counteracted. The organ is also concerned in the decomposition of proteids and even in the transformation of fats. In like manner the kidneys and the pancreas have intestinal functions, the nature of which is still obscure to physiologists. Lastly, the selective actions of epithelial cells are receiving greater attention, and it is found that these play an important part in many vital phenomena. By the activities of these cells physical operations, such as the passage of certain substances through membranes, are so modified as to make it impossible, in the present state of science, to regard them as purely physical. A molecular physiology of the future may demonstrate that they are truly physical, but at present the vitality of the tissues involved is an unexplained factor in the process.

In the field of physiological acoustics the phonograph promises to be an instrument valuable in research. Soon after its invention the tinfoil phonograph was used successfully by the late Professor Fleeming Jenkin and Professor Ewing (now of Cambridge) in the investigation of vowel sounds,

but the instrument was little known to physiologists. Since 1890, however, it has in its improved form, with a wax cylinder, engaged the attention of Professor Hermann, of Königsberg, and more recently of Dr. Boeke, of Alkmaar, and of Professor M'Kendrick, of Glasgow. By an ingenious method of photographically recording the vibrations of the marker that runs over the impressions produced by sounds on the wax cylinder of the phonograph, and which, by acting on a thin glass plate, reproduces the sounds, Hermann has obtained the curves corresponding to the tones of the vowels, and he has shown that the vowels are true musical tones, each having its own proper pitch, and not, as Von Helmholtz supposed, the pitch of a harmonic tone corresponding to the shape of the oral cavity when the vowel sound is uttered. When one considers that the phonograph can faithfully reproduce human speech, the sounds of a musical instrument, of a quartette or chorus of human voices, or the sounds of an orchestra, and that all these sounds and tones are imprinted on the wax cylinder of the phonograph in the form of a more or less complicated wave, it is manifestly of great importance to determine the wave form for any particular sound. If this could be done, not only would it be of great scientific interest to submit the curve to harmonic analysis (as was done by Jenkin and Ewing), and thus determine the component waves, but it might be possible to cut the curves on the margin of a wheel, or other appropriate device, and thus construct a speaking or singing machine. Speech and song and orchestral effects might be multiplied mechanically. The grooves on the wax cylinder vary in depth from the 1–1000th to the 1–2000th of an inch, and, thus, as the curve is in the bottom of the groove, it is a difficult matter to trace its form. Boeke has measured the transverse diameters of the grooves at different points, and from these measurements he has calculated the depths, and thus he has endeavoured, as it were, to construct the curve. M'Kendrick has taken direct photographs of the marks on the wax cylinder, and has thus been able to demonstrate vibrations (or 'dabs' on the wax cylinder traveling with great velocity) made at the rate of 1,500 to 1,800 per second. He has also shown that there is a definite form of these markings for pure tones, for the simpler chords, and for very complex tones, such as those of the organ, piano, or a quartette or chorus of human voices. By adapting large resonators to the phonograph, M'Kendrick has also made it possible to so increase the volume of tone as to make it audible even in a hall of considerable size. Edison and others have frequently used large resonators, but M'Kendrick has gone further in this direction. Recognizing, however, that resonance cannot increase the volume of tone beyond a certain limit, he has made use, with much success, of Mr. Alfred Graham's ingenious loud-speaking telephone, along with a transmitter of variable resistance, as supplied by Messrs. Muirhead and Co., of Westminster. In this way the tones of the phonograph are much amplified in volume and improved in quality. To physiologists the interest of these researches lies in the mode of action of the vibrating plate of the phonograph. This acts like the drumhead of the ear. Consequently the better the modes of movement of such a plate are understood the better can we explain the mechanism of the drumhead of the ear—a drumhead, however, infinitely more sensitive than the phonograph plate.—*London Times.*

CURRENT NOTES ON PHYSIOGRAPHY (XIII.).

THE CATOCTIN BELT OF MARYLAND AND VIRGINIA.

THE Blue ridge, dwindling from the Carolina highlands, extends a few miles north of the Potomac at Harper's Ferry, there

overlapping the southern extension of South Mountain from Pennsylvania. Five or ten miles to the east, on both sides of the Potomac, Catoctin Mountain repeats in many respects the structural and geographical features of Blue Ridge and South Mountain. The geographical features of this region are described and explained in a valuable essay on the 'Geology of the Catoctin Belt' by Arthur Keith (14th Ann. Rep., U. S. G. S., 1895, 293–395). The Tertiary 'baselevel' is the most extended surface of the region. Catoctin and various other residuals of hard rocks rise above it, and numerous valleys are entrenched beneath it. Three stages of post-Tertiary denudation (two Pleistocene and one recent) are indicated by the 'baselevels' observable in the valleys. The even summits of Catoctin and the other residuals above the Tertiary plain indicate two stages of pre-Tertiary denudation; but these older 'baselevels' are now so greatly consumed that they are referred only in a general way to Cretaceous time. Judging by the volume of denuded rocks, the ratios of Tertiary, early Pleistocene, later Pleistocene and recent time are as 134, 1, $\frac{6}{8}$, and a 'small fraction.' The small consideration of marine erosion marks the essay as distinctly belonging to the American school.

The residual hills of this region are so characteristically developed that in 1891 McGee suggested the use of Catoctin as a generic name for such topographic forms (5th session, Internat. Geol. Congress, 249), in the same way that I have used Monadnock in New England (Nat. Geogr. Mag., V., 1893, 70). Recent practical experience has shown me that it is convenient to use both these terms; Monadnoch to apply to residual eminences that surmount peneplains of Cretaceous denudation, such as are common in the highlands of New England and Carolina, and Catoctic to apply to the residuals that surmount Tertiary peneplains, such as are common over the inner piedmont belt of Virginia. Whether so special a terminology will commend itself to general usage remains to be seen. It may be noted that Keith employs 'baselevel' in a topographic sense to which strong objection may be urged. (See Science, February 15, 1895, 175.)

RECENT TOPOGRAPHICAL MAPS.

Recent topographical sheets issued by the United States Geological Survey represent a number of areas of particular interest. Those for New York, the joint product of State and National funds, are especially welcome. The Oriskany, Oneida, Chittenango and Syracuse sheets portray the northern margin of the Alleghany plateau where it descends to the lowland of central New York; the eastern sheet includes Rome, where the Mohawk enters the broad valley that, according to Gilbert, once served as the outlet of the expanded Lake Ontario. The Syracuse sheet includes the beginning of a remarkable area of drumloidal drift hills, and also shows some of those curious abandoned channels near the margin of the plateau that seem to have been cut by temporary streams, constrained into peculiar courses by the melting ice sheet. Elmira and Rochester are included on other sheets of interest in connection with recent papers of Fairchild (see Science II., p. 11.; Amer. Geologist, xvi., 39–51). The Ithaca sheet illustrates the general dissection of the plateau and the morainic obstruction of some of its valleys, referred to by Chamberlin (3d Ann. Rept. U. S. G. S., 357). The Catskill and Rhinebeck sheets make the series for the Hudson almost complete from New York City to Albany. A large part of the Ausable basin in the Adirondacks is included in the Mt. Marcy, Ausable and Plattsburg sheets, offering interesting problems about lakes and gorges for attentive study. The Pulaski sheet at the eastern end of Lake Ontario exhibits the simplifi-

cation of an originally irregular shore line by cutting off headlands and throwing bars across bays.

In other States, the Bath (Maine) sheet is a remarkably effective illustration of a ragged coast line; it includes the northward deflection—presumably by drift barriers—of the Androscoggin at Brunswick to the expansion of the Kennebec in Merrymeeting bay. Wood River, Grand Island, Minden and Kearny sheets, Nebraska, show how the overburdened Platte sprawls across the Plains in its many channels. The shore line on the Seattle (Wash.) sheet has a number of low cuspate points, apparently small-scale examples of the action of eddying currents. For the most of us who cannot see the country itself, these maps are highly illuminating and suggestive.

THE DELAWARE WATER GAP.

THE plunging Medina sandstones that form Kittatinny mountain, the wall on the northern side of the Great Appalacian valley in Pennsylvania, are trenched across by a number of streams, all flowing from the region of the inner Alleghany ridges southeast towards the sea. It may be plausibly suggested that the ancestors of these streams originally ran to the northwest, as the New-Kanawha of Virginia still does; but that in Pennsylvania the drainage was afterwards turned to the present direction of discharge in some manner not now well defined but probably dependent on moderate deformation and the associated shifting of divides. The date of this change is not settled, but it is supposed to have been before the post-Cretaceous elevation of the region. This would imply that the Tertiary excavation of the broad longitudinal and the narrow transverse valleys or water gaps was accomplished by rivers running as a whole in their present courses.

A recent article by Emma Walters (Does the Delaware water gap consist of two river gorges? Proc. Acad. Nat. Sci., Phila., March, 1895) takes another view in suggesting that the most noted of the water gaps is the work of a river that ran northward for most of the time while it was cutting down the gap, and that it assumed its present direction in comparatively recent time. The local and immediate evidence quoted to indicate a northward flow is a pool, fifty to seventy feet deep, on the northern side of the hard sandstone sill of the gap; but the excavation of such a pool seems to be within the power of a strong river flowing in a narrow, curved channel. Collateral evidence of northward flow is found in the favorable interpretation of a number of indecisive observations made by various geologists, but the value of this kind of evidence is very uncertain.

W. M. DAVIS.

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PSYCHOLOGICAL NOTES.

THE SENSE OF EQUILIBRIUM.

DR. A. CRUM BROWN, in a lecture on 'The Relation between the Movements of the Eyes and the Movements of the Head' (printed in *The Lancet*, May 25th, and in *Nature*, June 20th), reviews the evidence that has led to the assumption that the semi-circular canals (together with the utricle and sacule) of the inner ear are sense-organs, giving us our information concerning position and equilibrium of the body. This view is now universally accepted, although the evidence is only circumstantial and not altogether conclusive to the present writer. There is no doubt but that injuries to the semi-circular canals cause corresponding disturbances in equilibrium, but dizziness and sickness are also caused by visual sensations. We may become dizzy from watching a waterfall, and when whirled about grow dizzy much more quickly when the eyes are open than when they are closed. It would seem that

our instinctive knowledge of equilibrium and of a motion of the body as a whole depends on very complex sensory impressions. One of these is very probably the pressure due to inertia of the perilymph and endolymph of the semi-circular canals, but it is quite possible that the inertia and weight of the soft parts of the head and body are more important factors. Rotation of the body would tend to cause congestion of the brain cortex by centrifugal action, and the resulting dizziness would be analagous to that accompanying intoxication or fever. The position of the body as a whole affects not only the circulation of the blood, but also the pressure of brain, viscera, etc., and the alterations in the direction in which gravity acts would cause important changes in muscular tensions. Motion of the body as a whole would cause pressure of the soft parts of the body on those more hard, and skin sensations (due to inertia of the body as a whole) would occur at points where the body touches other things. Sensations from the soles of the feet are of great delicacy, being part of the reflex mechanism which enables us to stand upright.

CONSCIOUSNESS AND THE ORIGIN OF SPECIES.

Professor Cope contributes to the July number of *The Monist* an article in which he formulates with great clearness the *Present Problems of Organic Evolution*. He sums up the positions of the Neo-Lamarckians and Neo-Darwinians in the accompanying table. It is of special interest to the present writer owing to the definition of the place of consciousness in the two theories, thus calling attention to the relations of modern psychological research and evolutionary theories. The general result of psychological investigation seems to increase the difficulties and decrease the need of assuming consciousness in causal interaction with the physical world, whereas the biologist finding physical causes insufficient adduces consciousness as a *vera causa* in the origin of species. J. McK. C.

1. Variations appear in definite directions.	1. Variations are promiscuous or multifarious.
2. Variations are caused by the interaction of the organic being and its environment.	2. Variations are 'congenital,' or are caused by mingling of male and female germ-plasmas.
3. Acquired variations may be inherited.	3. Acquired variations cannot be inherited.
4. Variations survive directly as they are adapted to changing environments (natural selection).	4. Variations survive directly as they are adapted to changing environments (natural selection).
5. Movements of the organism are caused or directed by sensation and other conscious states.	5. Movements of organism are not caused by sensation or conscious states, but are a survival through natural selection from multifarious movements.
6. Habitual movements are derived from conscious experience.	6. Habitual movements are produced by natural selection.
7. The rational mind is developed by experience, through memory and classification.	7. The rational mind is developed through natural selection from multifarious mental activities.

SCIENTIFIC NOTES AND NEWS.

THE PARALLAX OF ETA CASSIOPEIÆ DEDUCED FROM THE RUTHERFURD PHOTOGRAPHIC MEASURES.*

The new value of the parallax of this well-known binary star is not without considerable interest in view of the fact that it depends upon several pairs of comparison stars, thus eliminating largely, though, of course, not entirely, the disadvantages arising from the unknown parallaxes of the stars of comparison; whereas, in the two previous investigations by O. Struve and by Schweizer respectively, only *one* star has been used, and that probably the same star in both investigations, and one in such

*Based on Contributions from the Observatory of Columbia College, New York. No. 6. By Herman S. Davis.

a position relative to the proper motion of η Cassiopeiæ as to be most largely affected by any error in the assumed value thereof. Moreover, the value of +.″154 obtained by Struve has received a much larger share of credence than the circumstances connected with obtaining it would warrant—Struve himself saying of it: "la plus grande difficulté se rencontra dans les observations de η Cassiopeæ à cause d'une distance de 5′ pour l'étoile de comparison, distance qui atteint déjà les limites extrêmes de la bonne visibilité dans le champ de notre lunette." This is incidentally referred to by the author (page 305), where reference is given also to a remark, not very dissimilar, made by Socoloff relative to Schweizer's observations. Thus it may be seen that the want of near-by stars renders the determination of the parallax of this star very difficult, especially by micrometrical observations; and though this difficulty is considerably lessened by the larger field of the Rutherfurd photographic plates, yet even now stars farther from the centre of the plate than would have been desirable under more favorable conditions had to be chosen. This seems not to have vitiated the result, for the values of parallax obobtained from the separate pairs are, with one exception, accordant within the limits of their probable errors. This exception may be due to a parallax or, not impossibly, to a proper motion of one or other of the comparison stars. This uncertainty, and the fact that the pairs g, h and i, j were, as the writer believes, included more to throw light upon the presence or absence of film-distortion than upon the parallax, has influenced Dr. Davis to prefer the first of the two values he publishes, namely:

$$\pi = + 0.''443 \pm 0.''038 \text{ from three pairs,}$$

the other value being

$$= + 0.''465 \pm 0.''034 \text{ from six pairs.}$$

Using the first value, therefore, and the elements of this binary system as given by Dr. See in *Ast. Journ. 343*, it is interesting to note that the distance of this star from the earth is about seven and one-third 'light years' and that the combined mass of Eta and its companion is only .175 as great as the mass of our sun, and that the relative orbit in which these two stars revolve about this common centre of gravity is very nearly equal to that in which the planet *Neptune* circles about the sun.

THE MARINE BIOLOGICAL LABORATORY.

IN the prefatory note to the biological lectures delivered at Woods Holl, 1894, Professor Whitman writes as follows: "When the first volume of these lectures was offered, in 1890, their continuance as an annual publication was thought of only as a possibility; it was not promised, nor, indeed, suggested. The usefulness of such lectures had only been tested by a single summer's experience; and, although it was certain that they served a good purpose in the work of the laboratory, the advisability of publishing them was doubtful. While the reception accorded to the two volumes already issued indicates that it would not now be presumptuous to announce the hope of continuing them, it would be rash to promise this in the present state of uncertainty regarding the future of the laboratory. The laboratory is an experiment to test the extent of our need and the possibility of securing general coöperation. It has furnished a demonstration in both these respects; but it remains to be seen whether this will suffice to bring to it the necessary foundation of a large endowment. Special thanks are due to those who, in reviewing the 'Biological Lectures,' have called attention to the nature and purpose of this experiment and to the high importance of the end proposed. The project appeals, not for government support, but to private munificence, and every authoritative con-

firmation of its merits adds strength to our effort." There is perhaps no institution in America accomplishing more for the advancement of science with a limited expenditure and none more deserving of a larger endowment.

THE POPULATION OF FRANCE.

It is well known that the lack of increase of the population of France causes serious anxiety to its statesman. M. Chervin has recently presented some statistics before the *Société d'Anthropologique* which we quote from *The Lancet*. The table gives in the first column the number of legitimate living children born per thousand women aged between fifteen and fifty years. The corresponding number of illegitimate children is given in the second column.

German Empire	270	26.5
Scotland	269	19.9
Belgium	265	19.8
Italy	251	24.6
England	250	12.1
Austria	250	44.4
Sweden	240	(?)
Ireland	240	4.1
Switzerland	236	10.2
France	163	16.7

M. Rochard has recently attributed the low birth rate in France to alcoholism. The annual consumption of alcohol is 6.45 centiliters per person per annum, and there is in Paris one wine shop for every three houses. The birth rate is, however, undoubtedly due largely to French social customs—to prodigality in Paris and thrift in the provinces.

KARL LUDWIG'S LIBRARY.

The physiological library of the late Professor Ludwig is offered for sale by Th. Stauffer, 26 Universitäts Str., Leipzig, who has in preparation a catalogue which he will send on application. It would be a great advantage if some American institution could purchase the library as a whole. The library includes 10,000 memoirs, pamphlets and dissertations on anatomy, physiology and related subjects, which are offered for 6,000 marks. In addition, several valuable sets of journals are for sale. As it is becoming continually more difficult to secure sets of these journals, we give the following details:

Annalen der Chemie und Pharmacie (1832–1893) 2,500 M. Annalen der Physik und Chemie (1824–1892) 2,650 M. Zoölogischer Anzeiger (1878–1893) 160 M. Archiv für Mikroskopische Anatomie (1865-1895) 1,300 M. Archiv für Physiologie (1877–1894) 420 M. Bericht über die Fortschritte der Anatomie und Physiologie (1856–1871) 50 M. Berichte der Deutschen Chemischen Gesellschaft (1868–1893) 600 M. Centralblatt für die Medicinischen Wissenschaften (1–33) 200 M. Die Fortschritte der Physik (1845–1888) 450 M. Mediscinishe Jahrbucher (1871–1888) 150 M. Jahresbericht über die Fortschritte der Anatomie und Physiologie (1873–1893) 330 M. Jahresbericht über die Fortschritte der Chemie Physik u. Mineralogie (1847–1893) 775 M. Jahres Bericht über die Fortschritte der Thierchemie (1871–1893) 300 M. Göttinger Nachrichten (1862–1894) 95 M. Proceedings of the Royal Society of London (1866–1895) 300 M. Philosophische Studien (1883–1895) 120 M. Philosophical Transactions of the Royal Society of London (1875–1894) 600 M. Zeitschrift für Analytische Chemie (1862-1883) 270 M.

THE AMERICAN PHILOLOGICAL ASSOCIATION.

The twenty-seventh meeting of the American Philological Association was held at Western Reserve University on July 12th, under the presidency of Professor John Henry Wright, of Harvard University, who delivered an address on the 'Function of the Imagination in Classical Philology.' More than twenty papers were

presented before the meeting, among which may be mentioned as of general scientific interest an address by Professor George Hempl, of the University of Michigan, who exhibited some 'American speech maps' showing the geographical distribution of various dialectical peculiarities, and a description by Professor Schmidt-Wartenberg, of Chicago, of Rowsselot's phonetical apparatus which, it is hoped, will facilitate the study of speech from a physical standpoint. The report of the committee appointed at the Philadelphia meeting last winter to take steps toward some practical outcome of the following resolution: "That in the opinion of the American Philological Association, in any programme designed to prepare students for the classical course, not less than three years of instruction in Greek should be required," was presented. The action of the committee in drawing up and widely distributing an address on this subject was approved by the Association.

The next meeting will be held at Providence, R. I., on July 7, 1896.

GENERAL.

PROFESSOR W. RAMSAY read a paper before the Chemical Society of London on June 20th, in which he stated that there is no doubt but that argon and helium contain as a common ingredient a gas not hitherto identified, two lines in the spectra in the newly discovered elements being identical. The atomic weight of the new gas would be about 10. In the issue of *Nature* for July 4th Professor Ramsay states that he has demonstrated the presence of both argon and helium in a meteorite from Augusta County, Virginia. The characteristic spectrum of argon is almost completely masked by the presence of a few parts per cent. of nitrogen or of hydrogen, and that of helium is similarly affected, though to a less degree. In so far as the lines of the argon spectrum have not been identified in the spectra of stars it is probably because they are masked by the spectra of hydrogen and carbon.

IN the *American Naturalist* for July an account is given of the Hopkins Seaside Laboratory. The laboratory is located at Pacific Grove, a seaside resort on the southern shore of Montery Bay, about four hours distant by train from San Francisco. The coast line at this point offers every variety of rocky and sandy shores, and the variety and abundance of marine life is exceptionally great. The original building contains three general laboratories, a store room and seven private rooms for investigators; the new building contains a general lecture and library room, a general laboratory, ten private rooms for investigators and a dark room for photographic work. The basement is designed for large aquaria. The buildings are supplied with running water, both salt and fresh. The session (which is the fourth) began on June 17th, and the regular course of instruction continues till July 17th, but investigators and students not requiring instruction may continue their work during the summer.

ACCORDING to the *Genie Civile*, quoted in the *Scientific American*, the Geographical Society of Toulouse has for some years been studying the possibility of the application of the decimal system to the measurement of time and angles. As a result of these studies, a scheme has been devised which is to be presented to the coming Geographical Congress in London. It is proposed to divide the circle into 100 'cirs' (abbreviation of circulus), with decimal subdivisions of 'decirs,' 'centicirs,' 'millicirs' and 'dimicirs.' The letter X (initial letter of Greek κυκλος) is chosen to represent the cir, and an angle of 7 cirs, 77 centicirs and 51 dimicirs would, therefore, be written $7^{x}7751$. For the decimal measurement of time, the day, from midnight to midnight, is di-

vided into 10 decimal hours, each hour into 10 'cés' (abbreviation of centijour), each cé into 10 'décicés' or decimal minutes, and the latter into 'centicés,' 'millicés,' 'dimicés,' etc.

M. M. Delebecque and Le Royer's report to the Paris Academy that they have found that the quantity of air dissolved in water in the Lake of Geneva is independent of the pressure of the water, being slightly greater (owing to the decrease of temperature) at the bottom than at the surface.

The *Société d'encouragement pour l'industrie nationale* held its annual meeting for the distribution of the awards of the Society on June 28th. A large number of prizes and medals were awarded, among which may be mentioned the large prize of 12,000 francs awarded every six years for the invention most useful to French industry, which was given to M. G. Lippmann for the invention of color photography. The large gold medal awarded every three years for the work that has exercised the greatest influence on French industry during the six preceding years was awarded to the 'Comité de l'Afrique française' for their publications. Among the prizes is one awarded to the artisan who has worked for the greatest number of years in a chemical factory.

At the meeting of the Astronomical and Physical Society of Toronto, held July 9th, Mr. Thomas Lindsay read the introductory chapter to a series of papers which it is his intention to present as an historical sketch of the Greenwich Nautical Almanac, which was claimed to be next to the Bible the greatest production of the printing press.

A state civil service examination will be held in Albany on August 6th for candidates for the position of fish culturist in the State Fish, Game and Forest Commission. The salary is $3,000.

The British Medical Journal states that the following names of distinguished scientific and medical men will be given to different Paris streets: Trousseau, Charcot, David Ulysse Trélat, Milne Edwards, Jean Baptiste Dumas.

The Pan-American Congress of Religion and Education met at Toronto from the 18th to the 25th of July.

A specimen of the egg of the great auk was recently sold in London for £173–5–0. This specimen, which is perfect, was taken in Iceland some 60 or 70 years ago and comes from the collection of Baron d'Hamonville.

Henry Holt & Co. announce for publication an authorized translation of Paulsen's 'Introduction to Philosophy,' by Prof. Frank Thilly, of the University of Missouri, with a preface by Prof. William James, of Harvard University.

At the meeting of the Paris Academy of Sciences, on June 4th, Prof. Fuchs was elected correspondent in geometry in the place of Weierstrass; Dr. Nansen was elected correspondent in the section of geography, succeeding Nordenskiold, and Dr. Lavaran correspondent of the section of medicine and surgery in the place of Hannover.

The *Botanical Gazette* announces the death of Julian Deby, known for his study of diatoms.

UNIVERSITY AND EDUCATIONAL NEWS.

The University of Pennsylvania has issued an appeal asking for an endowment fund of $5,000,000 to meet the immediate requirements of the University. Mr. Thomas McKean has given without restrictions a sum of $50,000 in addition to the $50,000 given a few month ago. A contribution of $10,000 has also been received from Mr. Richard F. Loper to name a house in the new dormitory. It is stated that this is the thirteenth contribution of a similar kind that has been received.

IT is stated that the University of Cincinnati has received a gift of $45,000 from Mr. Henry Hanna, to be used in the erection of a wing in the new University building.

THE Belgium ambassador in Berlin has called the attention of the German government to the fact that imitations of the stamp of the University of Ghent have been counterfeited with a view to selling diplomas of the University, and the Berlin Foreign Office gives warning of the existence of these documents.

PROFESSOR WILLIAM J. HUSSEY, of Illinois, has been appointed to succeed Professor Bernard as astronomer of Lick Observatory.

DR. L. A. BAUER, formerly of the U. S. Coast and Geodetic Survey, is lecturing this year on mathematical physics and on geophysics at the University of Chicago.

J. ALLEN GILBERT (Ph. D., Yale) has been made assistant professor of psychology at the University of Iowa.

PRINCIPAL PETERSON has been presented with a gift of silver plate on the occasion of his leaving the University of Dundee to become president of McGill College, Montreal.

IT is stated that J. H. Tyrrell, of the Geological Department of Canada, will be elected professor of geology and mineralogy in the University of Toronto, succeeding Professor Chapman, who has just resigned.

IT is stated that Professor Hering, of Prague, has been offered the chair of physiology, vacant by the death of Professor Karl Ludwig.

DR. ELEXANDER ROLOSSOW has been appointed professor of histology and embryology in the University of Warsaw in the place of Dr. H. Hoyer, who has resigned.

DR. SOMMER, professor of anatomy in Greifswald University, has tendered his resignation, to take effect on September 1st.

WE learn from the *Naturwissenschaftliche Rundschau* that the geologists Dr. Robert Scheibe and Dr. Fritz Kötter have been appointed professors in the Bergakademie, of Berlin. Dr. Rex and Dr. Steinbach have been appointed to assistant professorships of anatomy and physiology, respectively, in the University of Prague.

DR. TH. CURTIUS has declined a call to the professorship of chemistry in the University of Tübingen, vacant through the death of Lothar von Meyer.

PROFESSOR H. WILD, director of the Central Observatory, University of St. Petersburg, has resigned his position on account of ill health.

CORRESPONDENCE.

BALM FOR WOUNDED AUTHORS AND PROOF-READERS.

THE recent receipt of Dr. Wortman's memoir 'On the Osteology of Agriochœrus,' like its several predecessors published within a year or so, has recalled a remarkable lapse of memory occuring to two of the most eminent and sagacious naturalists of all time. The case is of psychological significance, and I have thought it might amuse as well as interest readers of SCIENCE.

Prof. Huxley, in his excellent 'Introduction to the Classification of Animals' (published in 1869), in his first chapter 'On Classification in General,' concluded a consideration of Cuvier's law of the correlation of structure with the following paragraphs:

"Cuvier, the more servile of whose imitators are fond of citing his mistaken doctrines as to the nature of the methods of palæontology against the conclusions of logic and of common sense, has put this so strongly that I cannot refrain from quoting his words.*

"But I doubt if any one would have divined, if untaught by observation, that all ruminants have the foot cleft, and that they alone have it. I doubt if any one would have divined that there are frontal horns only in this class; that those among them

* Ossemens fossiles, ed. 4me, tome, 1r, p. 184.

which have sharp canines for the most part lack horns.

"However, since these relations are constant, they must have some sufficient cause; but since we are ignorant of it, we must make good the defect of the theory by means of observation; it enables us to establish empirical laws, which become almost as certain as rational laws, when they rest on sufficiently repeated observations; so that now, whoso sees merely the print of a cleft foot may conclude that the animal which left this impression ruminated, and this conclusion is as certain as any other in physics or morals. This footprint alone, then, yields to him who observes it, the form of the teeth, the form of the jaws, the form of the vertebræ, the form of all the bones of the legs, of the thighs, of the shoulders, and of the pelvis of the animal which has passed by; it is a surer mark than all those of Zadig."

The first perusal of these remarks would occasion surprise to some and immediately induce a second, more careful reading to ascertain whether they had not been misunderstood. Men of much inferior capacity than Cuvier or Huxley, like myself, must have at once recalled living exceptions to the positive statements as to the coördination of the 'foot cleft' with the other characters specified. One of the most common of domesticated animals—the hog—would come up before the 'mind's eye,' if not the actual eye at the moment, to refute any such correlation as was claimed. Nevertheless, notwithstanding the fierce controversial literature centered on Huxley, I have never seen an allusion to the lapse. And yet every one will admit that the hog has the 'foot cleft' as much as any ruminant, but the 'form of the teeth,' and the form of some vertebræ are quite different from those of the ruminants, and of course the multiple stomach and adaptation for rumination do not exist in the hog. That any one mammalogist should make such a slip is not very surprising, but that a second equally learned should follow in his steps is a singular psychological curiosity. To make the case clearer to those unacquainted with mammals, I may add that *because the feet are cleft in the same manner* in the hogs as in the ruminants, both groups have long been associated in the same order under the name of Paridigitates or Artiodactyles, contrasting with another (comprising the tapirs, rhinocerotids and horses) called Imparidigitates or Perissodactyles.

I need scarcely add that the law of correlation applied by Cuvier to the structures of ruminants entirely fails in the case of many extinct mammals discovered since Cuvier's days. Zadig would have been completely nonplussed if he could have seen the imprint of an Agriochœrid, a Unitatheriid or a Menodontid.

Another instance of failure of observation or memory nearly equally remarkable was published several years ago in various daily papers, and the following extract from one of them is given:

"FOUR INTELLIGENT PROOF-READERS.

"The question whether a proof-reader must have knowledge of the contents of any article that passes through his hands having been discussed in a German paper, the *Frankfurter Zeitung*, brings the following amusing contribution from Prof. Karl Vogt, the celebrated scientist, in illustration of this problem.

"When Edward Desor and myself were working with Agassiz at Neuenburg [Neuchâtel] my friend Desor was charged with describing certain fossil fish after the latter's notes. Desor used to dictate these descriptions to a young man who pretended to know all about it, while Desor counselled him to consider himself merely an unconscious tool. To sound the knowledge of his clerk, my colleague one day, under my connivance, dictated to his secretary the most absurd nonsense by interlacing the description of some fossil fish with the particular statement. 'This remarkable specimen differs from all others in the abnormal fact of having its head in the same spot where the others' tails are found.' The clerk took everything down as it came from the lips of my collaborator without rebelling. Desor, accidentally being called away, forgot his trick, and the manuscript went to the printing office. The proof was read by Dr. G., who had expressly been appointed to the post by Agassiz, and besides entrusted with the compilation of his 'Nomenclator.' Desor and myself read the second proofs; so did Agassiz, who placed his imprimatur upon them, but none of us four took notice of the nonsense it contained. The whole was printed, and only then, when the series was about to be sent

to the subscribers, my friend Desor remembered the trick he had played on his amanuensis. A special card had to be inserted in place of the objectionable passage. The conclusion may easily be drawn—four proof-readers had read the article without consciously taking knowledge of its contents."

I suppose that every author who has published much must have felt disgusted at finding some glaring error in a paper of which he had read the proofs and yet failed to detect. Such failure is not very surprising, however, as attention is concentrated on form and typography. But it is surprising that four men of such learning as Agassiz, Desor, '(G.)' and Vogt should all have passed unnoticed the evident absurdity quoted by Prof. Vogt. Perhaps the fact they did so may reconcile others to their blunders. I offer this balm (which has been of service to me!) for those interested. Yours truly,

THEO. GILL.

WASHINGTON, July 11, 1895.

THE GENERIC NAME ANISONYX PREOCCUPIED.

IN the first number of the new series of SCIENCE (Vol. I., No. 1, Jan. 4, 1895, 18–19) I called attention to the fact that the generic name *Anisonyx* of Rafinesque (1817) antedates *Spermophilus* of Cuvier by eight years, and seemed to be the earliest available name for the ground squirrels. Fortunately, however, *Anisonyx* is preoccupied. In a rare work by Latreille entitled *Genera Crustaceorum et Insectorum*, and published in 1807, the name *Anisonyx* was proposed for a genus of Coleoptera, thus antedating Rafinesque's use of it by ten years.

C. HART MERRIAM.

CORRECTION.

IN the review of the Twenty-third Annual Report of the Geological Survey of Minnesota, etc., in SCIENCE of July 5, p. 23, first column, near top, the Keewatin rocks are referred to the Upper Algonkian, of the U. S. Geological Survey, whereas they should have been referred to the *Lower* division. EUGENE A. SMITH.

SCIENTIFIC LITERATURE.

Les aurores polaires. By ALFRED ANGOT. Paris, Felix Alcan. 1895. Bibliothèque Scientifique Internationale. 230 pages with an appendix catalogue and many illustrations.

The well known meteorologist of the Bureau Central Météorologique takes occasion to say, in the introductory chapter of this book, that the lack of any volume in French dealing exclusively with the aurora, since the time of Bravais, 1839, was a prime consideration in the issue of this volume. Information concerning the aurora had to be sought in stray notes, miscellanies, etc. Our author attempted a partial remedy by contributing in 1882 to 'La lumiére électrique' a series of ten papers giving a general view of our knowledge of the aurora; and the present volume consists practically of these ten papers expanded and brought up to date. Appearing in 1895, some mention of Lemstrom's 'l'Aurore boreale' (1886) and Paulsen's 'Contribution a notre connaissance de l'aurore' (1889) might have appropriately been made; and the omission is the more noticeable in that the former work is referred to in the chapter on the physical character of the aurora.

The illustrations are chiefly reproductions of sketches made by French observers in high latitudes; but it must be confessed that sketches made in 1839, 1870 and 1879 seem a trifle antiquated. No mention is made of the fact that the aurora has been photographed. Tromholt made an attempt as early as 1885 to do this. Very fair photographs considering the conditions were obtained in 1892 by Dr. Martin Brendel and Herr O. Baschin at Bossekop.

The form and appearance of auroras, their physical character, frequency, relation to

the weather, etc., are treated pleasantly in various chapters; but the chief results of the International Circum-polar Stations are hardly alluded to. In the chapter on theories respecting the origin of the aurora no mention can be found of Lockyer's ingenious meteoric theory. The data given respecting the height of the aurora are likewise far from complete; and in the table on page 71, giving wave-lengths of lines found in the auroral spectrum, only 14 lines are given, which doubtless was the full number in 1882, but which now contrasts strangely with Gyllenskiold's detailed description of 32 lines.

Lemstrom's experiments upon the artificial reproduction of the aurora do not seem to our author to be all that has been claimed for them; and, after noticing Tromholt's unsuccessful attempt with similar apparatus, he gives the experience of M. Vaussenat at the Pic du Midi, who, at an elevation of 2,877 metres, with a network of wire covering an area of 640 square metres, obtained nothing in the way of an artificial aurora. So, like many another explanation of the aurora, this may be laid away for the present as unproven. The true relation of the aurora to magnetic perturbations still remains to be determined. Angot repeats a suggestion which has been made elsewhere, viz.: that many of the difficulties which now present themselves in connection with auroras and magnetic perturbations will disappear if it be understood that, under the one name of aurora, we are now classifying phenomena which may be of very different natures. Let us make one class of auroras embrace those widely extended magnificent displays which are accompanied with magnetic disturbances, and another class those displays which are local in character and more in the nature of manifestations of atmospheric electricity.

There remains little to be said about the relation of sun-spots and auroras, other than that the agreements thus far made out are, it is to be feared, more apparent than real. We seem, indeed, to be but little removed from the military authorities who, at Copenhagen in 1709, during a very brilliant aurora, ordered that the troops be paraded, the drums beaten and arms presented. We are able to do as little. A. M.

Geological Survey of Michigan. L. L. Hubbard, State Geologist. Vol. v., 1881–1893. Part I. Upper Peninsula, 1881–1884. Iron and Copper Regions, by Carl Rominger, pp. 179, 3 plates and a map. Part II. Geology of Lower Michigan, with reference to deep borings. C. E. Wright and A. C. Lane, with an introduction by L. L. Hubbard, pp. 100, plates LXXIII. and a map. Lansing, 1895.

The Geological Survey of Michigan is to be congratulated on finally possessing, as we learn from this report, a house of its own, where its collections can be permanently stored and kept together for reference. There is so much complexity in the geology of the Upper Peninsula, and so much importance attaches to the determination of obscure species of rocks, that a permanent home is indispensable, and the sole regret is that it was not earlier attained. The volume before us resumes, in the same style, the series of Michigan reports that temporarily ceased with the issue of Vol. IV., in 1882. Part I. consists of a manuscript of Dr. Carl Rominger, formerly State Geologist, that was prepared about 1882, and has remained unpublished to date. To properly appreciate Dr. Rominger's paper on the iron districts one must place one's point of view back in 1883 and efface from mind as far as possible the work of Irving, Van Hise and G. H. Williams, the reports of Wadsworth, the reviews of Alex. Winchell and many other minor papers on the petrography and stratigraphy of this difficult

region that have appeared since. The Gogebic district, that has proved the key to the structure of the other ranges, had not yet developed a mine when seen by Dr. Rominger, and in the older ranges the 'soft ores,' now the chief source of supply, were looked upon, when known, with more or less contempt. The paper is a further amplification of the author's previous report and is to be considered in this connection. Its chief value to-day is in its historical bearings and in the fact that it does its author the justice of finally issuing his work. Otherwise, lacking, as it is, in sections, geological maps and illustrations, it forms for a general reader a rather disjointed series of observations.

The chapter on the Keweenaw group of copper-bearing rocks stands much better by itself. The geology of the country is much simpler than in the iron regions, and not much important additional work has been done in the last ten years. The report is brought down to date, also, by recently acquired data. Accurately plotted cross-sections afforded by the deep Tamarack shafts, and by long prospecting drifts in the Calumet and Hecla mine, illustrate admirably the astonishing succession of basaltic eruptions that go to make up the Keweenawan formation. The report furnishes thus an excellent short account of the geology of Keweenaw Point, of the adjacent mainland, and of the copper mines. As such it is to be commended to the general reader. When we read of the extensive prospecting and exploration that have so widely opened up the surface and that have so often been without remuneration, we cannot but regret that we do not better understand the laws of the precipitation and distribution of the copper. Despite Professor Pumpelly's brilliant and suggestive thesis, most observers familiar with the mines feel that the whole story has not yet been told.

Part II. is a very valuable contribution, and more than Part I. brings out that which is new. Dr. Hubbard's introduction is timely. It sets forth the views of Ochsenius on the origin of thick deposits of rock, salt, gypsum and their associates, and places before American readers what is really the only good explanation of their formation. The 'bar theory,' based, as it is, on true chemical principles and necessary geological relations, lays us under obligations to Ochsenius that are no less important in their scientific than in their economic relations. As applied to petroleum, however, there is little in the geology of our serious oil regions, so far as yet opened up, that indicates any notable connection between the 'mother liquors' of an evaporating estuary and these stored up reservoirs of hydrocarbons. The main part of the paper consists of Dr. Lane's revision and elaboration of notes which were mostly accumulated by the late State Geologist, Charles E. Wright, whose untimely death removed a vigorous worker in the midst of his career. The records of the wells sunk for brines or in the search for oil and gas have afforded a vast amount of valuable information about the stratigraphy of the Lower Peninsula. These have been elaborated by Dr. Lane in a very admirable way. After a brief introduction regarding the gaps in the record, and the errors that creep into observations of this character, a review is given of the stratigraphy of this portion of the State, which is to be commended to any reader who desires a brief account of the thickness and arrangement of the formations. The records are then plotted in numerous diagrams, from which sections are assembled that cross the geosyncline in five or six different places. A descriptive text accompanies the sections, arranged by towns in alphabetical order. The report cannot fail to be of equal interest to scientific men and to those who are engaged in the rapidly growing industries

based on brines and gypsum. Whether an oil field lies under the surface is a question which only the explorations of the future can solve. J. F. Kemp.

Veröffentlichungen aus dem Königlichen Museum für Völkerkunde. Berlin. 1895.

The above named publication by the Museum of Ethnography in Berlin appears quarterly in large folio form, and consists of special studies by experts in some of the lines of anthropologic science.

The last number, Band IV., Heft 1., deserves separate mention for the valuable contributions it contains to American archæology. It presents three articles, each of which is a model in its way.

The first is a descriptive catalogue of a collection of idols, fetishes and priestly ceremonial objects from Zuñi, collected and explained by Mr. Frank Hamilton Cushing, and now deposited in the Berlin museum. It is illustrated with 26 drawings inserted in the text, and the purposes of the objects with their mythological associations are accurately set forth.

The second article is by Dr. Carl Sapper, on 'Ancient Indian Settlements in Guatemala and Chiapas.' It is accompanied by a most useful map of Chiapas, Tabasco, Guatemala and part of Honduras, giving the locations of the ancient native towns, caves containing remains, rock-drawings and localities deserving further investigations. To this are appended 20 plans of ancient ruined cities within the area mapped, a number of them entirely new, others more accurately drawn than in previous publications. Among them may be mentioned the famous Iximche, the capital of the Cakchiquels; Sacabajá, a city of the Quiches; Los Cuyes in the department of Huehùetenango; the rock-inscriptions of Zacualpa in Chiapas, and others. This archæological study will be of great use to future investigators.

The third article is an interesting study, by the eminent Americanist, Dr. Carl Seler, of a series of vases and similar objects brought by Dr. Sapper from Guatemala. It is illustrated by 104 drawings inserted in the text, and the subject is elucidated by the thorough acquaintance with the literature of the conquest which the author always has at command. A number of these vases are decorated with hieroglyphs of the form characteristic of the Mayan tribes. Some of these the author identifies with others in the manuscripts and sculptures, and suggests explanations for them. He is inclined to believe that such inscriptions indicate that the vases were manufactured elsewhere than where they were found; an opinion which will not hold, in view of the large number of sherds bearing glyphs obtained from the southern Mayan territory. This essay is a most important contribution to the study of the Mayan hieroglyphs.

D. G. Brinton.

SOCIETIES AND ACADEMIES.

THE ASTRONOMICAL AND PHYSICAL SOCIETY OF TORONTO.

At a meeting on June 11th the following notes on mass and temperature in the solar system were read by Mr. A. Elvins:

I have long thought that a relation exists between the masses of the heavenly bodies and their temperatures, the heat rising as the mass increases. Mercury is too near the Sun to be observed with much chance of success. Venus is somewhat better situated, but its brilliancy is so great that it is a difficult object to observe; its atmosphere, however, often shows dark patches, which I think may be openings through the general mass of clouds which seem to envelope the planet, reflecting light from their outer surface. Like the earth, I think it has polar caps of snow; I have seen a bright spot at the north pole on several occasions during the past fortnight, and similar observations have been previously

noted by other observers and myself. The mass of Venus approaches nearer to that of the earth than the mass of any other planet, and it will probably not be very different from the earth in its temperature.

In the case of the moon the temperature is probably very low. Peal and others regard it as glaciated. Langley says at full moon the temperature is not above 0° centigrade. I need not remind you that the mass of the moon is very small. The mass of Mars is only about one-ninth that of the earth, and it may be on the whole a colder world. The vast polar caps have a great resemblance to snow; they enlarge during the winter and decrease during the summer. The canals, about which so much has been written, are just as likely to be rents or fissures in ice fields, or vast ice crystals on the surface of liquid, as to be vegetation near artificial streams.

Jupiter is the giant world, and if the temperature increases with mass its heat must be very great. Careful scrutiny sustains this view; no polar snow caps can be seen; the belts and spots show so many changes that the best observers regard the planet as a very hot body. Proctor even contended that it radiated heat to the satellites, and was in that respect an additional sun to them.

This speculation is of great interest to me and I would be pleased sometime to continue the subject, but I think enough has been said to show that it is not void of interest, and that going outwards from the Sun temperature seems to increase with mass. I need scarcely remind you that the mass of the Sun itself is vastly greater than that of all the bodies of the system combined, and that his heat is enormous.

SCIENTIFIC JOURNALS.

AMERICAN CHEMICAL JOURNAL FOR JULY.

THE July number of the American Chemical Journal contains an article by W. F. Edwards entitled 'Notes on Molecular and Atomic Refractions.' He offered, sometime ago, a new formula, $\frac{P(M-1)}{MD}$, for molecular refraction, and the present paper contains the results of further research and comparisons of the results obtained by the use of his formula with those obtained with the formulæ of Gladstone and Lorentz-Lorenz. He has compared a number of cases of acids and ethereal salt and has determined the change caused by the addition of CH_2, and the numbers representing the atomic refractions of hydrogen, oxygen, nitrogen, chlorine, bromine, iodine and sulphur, in terms of his formula.

By the use of his formula he can tell whether the nitrogen is present in the trivalent or univalent condition; but with the others this is impossible. Although a great number of observations are available the results are not such as would render any general conclusions possible in many cases. Hite, and Orndorff and Cameron, describe the pieces of apparatus which they have devised for determining molecular weights by the boiling-point method. They both call attention to the great influence of pressure on the boiling point and the necessity of making corrections for it. The two methods vary in details, the apparatus of Orndorff and Cameron being much simpler and easily made by any student, while specially constructed apparatus is needed for Hite's method. Numerous examples are given by both of very satisfactory results obtained.

Seldner has tried parallel experiments to those of Gautier in which diacetamide is formed by heating acetonitrile and acetic acid together. He used glutaric acid and its nitrile, and whether he mixed glutaric acid and acetonitrile, or glutaric nitrile and acetic acid, or glutaric acid and glutaric nitrile, in each case he obtained the same product, the glutaramide. DeChalmot, who has been studying the pentoses of plants, advanced the hypothesis that in

plants pentose molecules are formed in complex molecules of hexosans in which a part or all of the aldehyde groups have been bound by condensation, and are thereby preserved from further oxidation. He considers the pentoses to be formed from hexoses by the end alcohol group being oxidized and then losing carbon dioxide. The investigation was only carried far enough to show that probably the hexosans are oxidized to the aldehyde.

H. C. Jones publishes the results of a method that can be used for the determination of formic acid by oxidizing it with potassium permanganate. The method he used was as follows: After making the formic acid solution alkaline with sodium carbonate, it was treated with an excess of a standard solution of potassium permanganate. The formic acid was all oxidized to carbon dioxide and water. The solution was then acidified and a measured volume of oxalic acid run in until the solution became clear, and the excess of acid determined by the permanganate solution. The two solutions were then compared and the necessary data secured for calculating the amount of formic acid.

Several reviews of books on chemistry are included in this number, the principal one being the review of Palmer's translation of Nernst's 'Theoretical Chemistry.'

J. Elliott Gilpin.

NEW BOOKS.

Zeit- und Streitfragen der Biologie. Oscar Hertwig. Vol. I. Jena, Gustav Fischer. 1894. Pp. iv+143. M 3.

Report of the International Meteorological Congress. Pt. II. Edited by Oliver L. Fassig. Washington, Weather Bureau. 1895. Pp. 583.

The Gospel of Buddha. Paul Carus. Chicago, The Open Court Publishing Co. 1895. Pp. xiv+275. 35 cents.

The Cell. Oscar Hertwig. Translated by M. Campbell and edited by Henry Johnston Campbell. London, Swan & Sonnenschien. New York, Macmillan & Co. 1895. Pp. vi+368. $3.

Hydrodynamics. Horace Lamb. Cambridge University Press. New York, Macmillan & Co. 1895. Pp. xviii+604. $6.25.

Transactions of the American Institute of Electrical Engineers. Vol. IX. New York City, The Institute. 1894. Pp. xii+938.

Petrology for Students. A. Harker. Cambridge University Press. New York, Macmillan & Co. 1895. 12mo. $2.

The Great Frozen Land. Frederick George Jackson. New York and London, Macmillan & Co. 1895. Pp. 414. $3.25.

Annuario publicato pelo Observatorio do Rio de Janeiro. Rio Janeiro, Lombaerts & C 1895. Pp. x+374.

Studies in Spherical and Practical Astronomy. George C. Comstock. Madison, Wis., The University. 1895. Pp. 106. 40 cts.

Experimental Study of Field Methods which will insure to Stadia Measurements greatly increased Accuracy. Leonard Sewal Smith. Madison, Wis., The University. 1895. Pp. 145. 35 cts.

A Contribution to the Mineralogy of Wisconsin. William Herbert Hobbs. Madison, Wis., The University. 1895. Pp. 156. 40 cts.

On the Quartz Keratophyre and associated Rocks of the North Range of the Baraboo Bluffs. Samuel Weidman. Madison, Wis., The University. 1895. Pp. 56. 25 cts.

The Finances of the United States from 1775 to 1789 with especial reference to the Budget. Charles J. Bullock. Madison, Wis., The University. 1895. Pp. viii+273. 75 cts.

Inductive Psychology. E. A. Kirkparick. New York and Chicago, E. L. Kellogg & Co. 1895. Pp. 208.